



PALEONTOLOGICAL SURVEY
San Juan Planning Unit
and
Rio Puerco Resource Area

PART II
Annotated Bibliography

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ASH, S. R., 1974.

Upper Triassic plants of Canon del Cobre, New Mexico.
New Mexico Geol. Soc. Guidebook, 25th Field Conf., 179-184.

This article reports the following plant fossils from the Aqua Zarca Sandstone Member of the Chinle Formation:

Conifers

Brachyphyllum sp.

Pagiophyllum newberryi

Araucarioxylon arizonicum

Cycadophytes

Otozamites macombii

Zamites occidentalis

BALTZ, E. H., JR., 1967.

Stratigraphy and regional tectonic implications of part of Upper Cretaceous and Tertiary rocks, east-central San Juan Basin, New Mexico.
U.S. Geol. Surv. Prof. Paper, 52:1-101.

This is a detailed stratigraphic study of the San Jose Formation. Four members were proposed--Cuba Mesa Member, Regina Member, Llaves Member, Tapicitos Member. These are mapped throughout a large area along the eastern side of the San Juan Basin.

BALTZ, E. H., S. R. ASH AND R. Y. ANDERSON, 1966.

History of nomenclature and stratigraphy of rocks adjacent to the Cretaceous-Tertiary boundary western San Juan Basin, New Mexico.
U.S. Geol. Surv. Prof. Paper, 524-D:1-23.

This paper summarized the history of the stratigraphy of this region. The Ojo Alamo Sandstone was restricted to the upper conglomerate of Bauer and the Naashoibito Member of the Kirtland Shale was defined. The following fossils were listed from the Kirtland Shale:

Fish

Lepisosteus sp. (scales)

Myledaphus sp. (teeth)

Squatinae (single tooth)

Turtles

Neurankylus baueri Gilmore

Baena ornata Gilmore

B. nodosa Gilmore

Boremys grandis Gilmore

Thescelus hemispherica Gilmore

T. rapiens Hay

Basilemys nobilis Hay

Adocus bossi Gilmore

A. kirtlandius Gilmore

Asperidites ovatus Gilmore

A. vorax Hay

Plastomenus robustus Gilmore

Compsemys sp.

Dinosaurs

Saurischia:

Large carnivorous dinosaurs:

Vertebrae

Deinodon sp.

Gorgosaurus libratus Lambe

Sauropod:

Alamosaurus sanjuanensis Gilmore

Ornithischia:

Duck-billed dinosaurs:

Kritosaurus navajovius Brown

Parasaurolophus tubicen Wiman

Horned dinosaurs (ceratopsians)

Monoclonius sp.

Pentaceratops sternbergii Osborn

P. fenestratus Wiman

Chasmosaurus sp.

Ceratops sp.

Armored dinosaur, scapula and dermal plates of unidentified form.

Crocodyles and alligators:

Crocodylus sp., teeth

Brachychampsia sp., teeth

BAUER, C. M., 1916.

Contributions to the geology and paleontology of San Juan County,
New Mexico, part 1. Stratigraphy of a part of the Chaco River Valley.
U.S. Geol. Surv. Prof. Paper, 98:271-278.

This early paper sets forth the principal features of the stratigraphy in the western part of the San Juan Basin. It describes the succession of strata irrespective of possible correlations and attempts to establish a type section for the formations exposed.

Concerning the Lewis Shale, he mentions that on the San Juan River the formation contains a prominent layer of buff lime concretions about 100 feet above its base. Fossils reported from it are Anomia sp., Inoceramus sp., Lucina sp., Lunatia sp., Baculites sp., Inoceramus barabini Morton, Placenticeras intercalare Meek and Hayden, burrows, Ostrea inornata Meek and Hayden,

Syncyclonema sp., Leda sp., Cardium speciosum Meek and Hayden, Liopistha undata Meek and Hayden and Placenticerias sp.

Fossils reported from the Picture Cliffs Sandstone are abundant Halymenites major, Serpula pp., Inoceramus barabini Morton, Cardium speciosum Meek and Hayden, Tellina scitula Meek and Hayden, Leptosolen sp., Mactra gracilis Meek and Hayden, Corbula sp., Turris sp., Odontobasis sp., Haminea sp., and Actaeon sp.

BAUER, C. M. AND J. B. REESIDE, JR., 1920.

Coal in the middle and eastern parts of San Juan County, New Mexico.
U.S. Geol. Surv. Bull., 716:155-248.

This report deals with coals in the various coal bearing formations of the San Juan Basin. Fossils are mentioned in summarizing the age of these formations.

BEAUMONT, E. C. AND J. W. SHOEMAKER, 1974.

Upper Cretaceous coal in the Cuba-La Ventana--Torreon area, eastern San Juan Basin, New Mexico.

New Mexico Geol. Soc. Guidebook, 25th Field Conf., 329-332.

This article was a report on the coals located in a triangle formed by Cuba, La Ventana and Torreon Trading Post. Coal mining was active in this area during the 1920's and 30's with minor activity until the 1960's. Major resources, consisting almost entirely of coal beyond economic stripping depths, exist in the region. The coal-bearing strata are within the Menefee and Fruitland formations. The principal mines were the Cleary Mine in the W-1/2 Sec. 31, T19N, R1W; the Nance mine in E-1/2, Sec. 32, T19N, R1W; the Hoye Mine in NE-1/4, Sec. 19, T19N, R1W, and the San Miguel Mine in NE-1/4, Sec. 33, T20N, R1W. Because of the nature of these deposits, fossils should be associated with them.

BROWN, B., 1910.

The Cretaceous Ojo Alamo beds of New Mexico with description of the new dinosaur genus Kritosaurus.

Amer. Mus. Nat. Hist. Bull., 28:267-274.

A new locality for dinosaurs near Ojo Alamo in northern New Mexico was reported to the American Museum in 1902. In 1904, Brown secured a small but interesting collection of fossils. This represented a fauna distinctly older than the Lance Creek beds or Ceratops Zone and Hell Creek beds of the "Laramie" Cretaceous. In this fauna, turtle bones were frequently found with those of dinosaurs. The most important fossil from this locality is a skull, lower jaws and atlas of a hitherto undescribed genus and species of the family Trachodontidae [Hadoosauridae], Kritosaurus navajovius (type specimen - AMNH No. 5799). These reptilian fossils came from shales about one mile south of the store at Ojo Alamo.

BROWN, B., 1914.

Cretaceous-Eocene correlation in New Mexico, Wyoming, Montana, Alberta. Geol. Soc. Amer. Bull., 25:355-380.

The author uses floral and faunal evidence, mostly vertebrates, to propose Cretaceous-Early Tertiary correlations in New Mexico, Wyoming, Montana and Alberta. Taxa are given at the genus and species level. The Puerco [Nacimiento] Formation and Ojo Alamo Beds represent the only stratigraphic units mentioned for New Mexico. The fauna includes several species of turtles, crocodiles and other reptiles and a fish. It also contains a few invertebrates and fossil plant remains.

BROWN, R. W., 1962.

Paleocene flora of the Rocky Mountains and Great Plains.
U.S. Geol. Surv. Prof. Paper, 375:1-119.

This report is an overview of fossil plants from the Paleocene epoch of the western United States. Brown synonymized many previously described species and formulated a tentative list of 170 recognizable species for this time period in this region.

Some of the localities he mentioned in his text are rather vague such as: "3 miles southwest of Farmington," or "1 mile northwest of Ojo Alamo, New Mexico." One locality for this area (Sec. 7, T30N, R7W, 1 mile above confluence of Los Pinos and San Juan rivers, New Mexico) was given in some detail.

BRUES, C. T., 1936.

Evidence of insect activity preserved in fossil wood.
Jour. Paleont., 10:637-643.

Two specimens of fossil wood containing excavations made by ants (Camponotus?) from a roadside locality approximately 50 miles south of Aztec, New Mexico on the highway between Aztec and Cuba, was described and illustrated. The fossils were from either the Torrejon or Puerco formations [Nacimiento Formation] of Paleocene age.

CLEMENS, W. A., 1973.

The roles of fossil vertebrates in interpretation of Late Cretaceous stratigraphy of the San Juan Basin, New Mexico.
Cretaceous and Tertiary Rocks of the Southern Colorado Plateau, Four Corners Geol. Soc. Mem., 154-167.

Sedimentary, non-marine, Late Cretaceous rocks are exposed in the Chaco River drainage system. Some areas contain rich concentrations of fossil

vertebrates. These vertebrates have helped determine the age of many of these units. The Hunter Wash local fauna (Fruitland and Kirtland Formations) from near Bisti Trading Post correlates roughly with the type Lance local fauna, parts of the Edmonton Formation, Judith River Formation and the Milk River Formation to the north.

COBBAN, W. A., 1951.

Scaphitoid cephalopods of the Colorado group.
U.S. Geol. Surv. Prof. Paper, 239:1-42.

Scaphitoid ammonites are abundant in some rocks of the Colorado group. On the south and east side of the San Juan Basin species of Scaphites are present in the Mancos Shale in the following localities:

Scaphites warreni and S. ferranensis: Senorita Canyon

Scaphites warreni: SW1/4 NW1/4 Sec 13, T23N, R1W.

Scaphites warreni: 5 miles from Gallina, near Lagoon, Rio Arriba Co.

Scaphites warreni and S. whitfieldi: 7.5 miles north-northeast of the northern end of El Vado Reservoir, Rio Arriba Co.

Scaphites warreni: upper Lagunas creek, Rio Arriba Co.

Scaphites warreni: East of Monero and north of D. & R.G.W. Railroad, NE T31N, R1E, 1000' below base of upper part of Hosta Sandstone Member of the Mesaverde Formation, Rio Arriba Co.

Scaphites warreni: 6 miles east of Seboyeta, 679 feet above base of Mancos Shale, Valencia Co.

Scaphites warreni: 5.5 miles north of Evan's Park, Cobollete Grant, 200' from top of formation, Sandoval Co.

S. whitfieldi: near Chama-Monerao Road, Rio Arriba Co.

S. whitfieldi: about 2.5 miles north-northeast of Evan's Ranch, Nuestra Señora de la Luz, de las Lagunitas Grant, 400 feet below the top, Sandoval Co.

S. whitfieldi: SW1/4, NW1/4, Sec. 5, T14N, R1W, top of Carlisle Shale Member of the Mancos.

These ammonites are very useful for correlation of Upper Cretaceous Rocks throughout the midwest.

COBBAN, W. A., 1969.

The Late Cretaceous ammonites Scaphites leei Reeside and Scaphites hippocrepis (DeKay) in the western interior of the United States. U.S. Geol. Surv. Prof. Paper, 619, 29 p. 5 Plates.

Scaphites leei and S. hippocrepis have been found in many areas of Montana, Wyoming, Colorado, South Dakota, Utah and New Mexico. Apparent sexual dimorphism is present in these two forms. There are three subspecies for each of these species. Some of their localities in New Mexico are within the study area and include the following: SE1/4, SE1/4, NE1/4, Sec. 11, T23N, R1W (590' and 560' below the top of the Mancos Shale); 3 miles north of Copper City, T20N, R1W (near the base of the Mesaverde Formation); NW1/4, SE1/4, Sec. 11, T20N, R1W (350' below the top of the Mancos Shale).

These forms are widespread, easy to identify and are useful for correlation throughout midwestern and western North America.

COBBAN, W. A., 1973.

Significant Ammonite finds in uppermost Mancos Shale and overlying Formations between Barker Dome, New Mexico, and Grand Junction, Colorado. Cretaceous and Tertiary Rocks of the southern Colorado Plateau, Four Corners Geol. Soc. Mem., 148-153.

The author collected the following from near Baker Dome:

Lewis shale: Baculites asperiformis, B. perplexus, Didymoceras, n. sp.,
D. nebrascense.

Pictured Cliffs Sandstone: Didymoceras cf D. cheyennense. Baculites
gregoryensis occurs along the east side of the San Juan Basin, probably in
the Lewis Shale.

COBBAN, W. A., 1977a.

Fossil mollusks of the Dakota Sandstone and intertongued Mancos Shale
of west-central New Mexico.
New Mexico Geol. Soc. Guidebook, 28th Field Conf., 213-220.

Marine fossils including bivalves, gastropods and ammonoids from 29
localities in the Dakota Sandstone and Mancos Shale of west-central New Mexico
are identified and illustrated. The assemblage is considered Cenomanian in age.
The Oak Canyon Member yielded 34 species of bivalves, 11 species of gastropods,
and 5 species of ammonoids. The Cubero Sandstone Tongue produced 19 bivalve
species, 1 gastropod species and 2 ammonoid species. The Clay Mesa Shale
Tongue contained only 9 species of bivalves and 3 ammonoid species.
The Whitewater Arroyo Shale Tongue produced 19 species of bivalves, 2
species of gastropods and 8 species of ammonoids. Collections from the
Twowells Sandstone Tongue contained 21 species of bivalves, 2 species of gastro-
pods and 5 species of ammonoids.

1 (D6191). South side of Tse Bonita Wash in the SW1/4 sec. 2, T16N, R21W.
Lower Part of Twowells Sandstone Tongue.

2 (D9240). Near Manuelito in the SE1/4 sec. 19, T14N, R20W. Brown-weathering
sandstone concretions in Twowells Sandstone Tongue.

3 (D6182) NW1/4 Sec. 14, T4N, R20W. Middle of Paguate Sandstone Tongue.

4 (D6184). Same locality as 3. Concretionary limestone bed near base
of Whitewater Arroyo Shale Tongue.

5 (D7345). NE1/4 SE1/4 Sec. 8, T14N, R13W. Top of a sandstone underlying
Whitewater Arroyo Shale Tongue.

- 6 (D5759). SW1/4 SE1/4 Sec. 24, T14N, R13W. About 10 feet (3 m) below top of Whitewater Arroyo Shale Tongue.
- 7 (D7335). SE1/4 SE1/4 Sec. 31, T15N, R12W. Twowells Sandstone Tongue.
- 8 (D7332). Drainage ditch near center of Sec. 4, T14N, R12W. Paguate Sandstone Tongue.
- 9 (D7328). NE1/4 NE1/4 Sec. 24, T15N, R12W. Upper part of Paguate Sandstone Tongue.
- 10 (D6131). NE1/4 Sec. 4, T7N, R10W. Base of Twowells Sandstone Tongue.
- 11 (D6781). SW1/4 Sec. 6, T8N, R9W. Brown-weathering limestone concretions in Clay Mesa Shale Tongue.
- 12 (D5741). Sharp road bend in the SE1/4 SW1/4 Sec. 27, T10N, R8W. Limestone concretion in upper part of Whitewater Arroyo Shale Tongue.
- 13 (D2048). NE1/4 Sec. 23, T9N, R8W. Cubero Sandstone Tongue.
- 14 (D2053). Deadmans Rock in the NE1/4 NE1/4 Sec. 7, T8N, R7W. Dark-brown weathering ferruginous sandstone concretions in Oak Canyon Member.
- 15 (D7364). Two miles (3.2 km) west of Acoma Pueblo in the SE1/4 SW1/4 Sec. 30, T8N, R7W. Gray limestone concretion 10 feet (3m) above base of Clay Mesa Shale Tongue.
- 16 (D5329). SE1/4 Sec. 36, T8N, R8W. Brown-weathering calcareous siltstone concretion 62 feet (19 m) above base of Oak Canyon member.
- 17 (D5330). Same locality as 16. Lower part of Cubero Sandstone Tongue.
- 18 (D5332). Same locality as 15. Limestone concretion 25 feet (7.6 m) above base of Clay Mesa Shale Tongue.
- 19 (D6794). North side of Paradise Canyon in the SE1/4 NW1/4 Sec. 24, T7N, R8W. Brown-weathering silty limestone concretion 80 feet (24 m) above base of Oak Canyon Member.
- 20 (D7084). Three miles (4.8 km) north of Laguna in the SE1/4 NE1/4 Sec. 20, T10N, R5W. Brown-weathering sandstone concretions in Paguate Sandstone Tongue.
- 21 (D5344). Bottom of arroyo in the NW1/4 NE1/4 sec. 29, T11N, R5W. Glauconitic calcareous sandstone concretion about 50 feet (15 m) below top of Whitewater Arroyo Shale Tongue.
- 22 (D5365). NE1/4 sec. 29, T12N, R3W. Brown-weathering sandy limestone concretion 66 feet (20 m) above base of Oak Canyon Member.
- 23 Rio Puerco about 10 miles (3 km) north of San Ignacio. Oak Canyon Member.
- 24 Southwest of San Ysidro. Paguate Sandstone Tongue.
- 25 (D5806). Bernalillito Arroyo in the SW1/4 sec. 21, T14N, R1W. Dark-brown-weathering calcareous sandstone bed in Oak Canyon Member.

- 26 (D5815). About 1-1/2 miles (2.4 km) N30E of Ojito Tank, Oak Canyon Member.
- 27 (D5380). About 1/2 mile (0.8 km) south of Chamisa Vega Spring in T17N, R1W. Clay Mesa Shale Tongue.

COBBAN, W. A., 1977b.

Characteristic marine molluscan fossils from the Dakota Sandstone and intertongued Mancos Shale, west-central New Mexico.
U.S. Geol. Surv. Prof. Paper, 1009:1-30.

Molluscan fossils are abundant in marine rocks of early Late Cretaceous Age (Cenomanian) on the south and southeast flanks of the San Juan Basin in northwestern New Mexico. Most specimens are found in silty limestone concretions, in calcareous siltstone and sandstone concretions, and in very fine grained sandstone and siltstone beds. The upper part of the Oak Canyon Member and the Paguate Sandstone Tongue of the Dakota Sandstone contain the greatest variety of fossils. Molluscan fossils also occur in the Cubero Sandstone Tongue of the Dakota Sandstone, Clay Mesa Shale Tongue of the Mancos Shale, Whitewater Arroyo Shale Tongue of the Mancos Shale, and Twowells Sandstone Tongue of the Dakota Sandstone.

- D5392 Landis and Cobban, 1967. SW1/4 SW1/4 Sec. 36, T19N, R1W., Sandoval County. Twowells Sandstone Tongue.
- D5819 Cobban, 1967. Same locality as D5392. Twowells Sandstone Tongue.
- D5377 Cobban, 1966. About 9/10 mile (1.4 km) southeast of Soda Spring on Arroyo Cachulie, in T17N, R1W., Sandoval County. Oak Canyon Member, from gray silty limestone concretions 62 ft (18.9 m) above base.
- D5380 Dane, Landis and Cobban, 1966. About 1/2 mile south of Chamisa Vega Spring in T17N, R1W., Sandoval County. Clay Mesa Shale Tongue, from unit of dark-brown-weathering siltstone concretions.
- D5372 Dane, Landis and Cobban, 1966. About 500 ft (152 m) west of Ojito Spring, in the NW1/4 NW1/4 Sec. 29, T16N, R1W., Sandoval County. Lower part of Paguate Sandstone Tongue.
- D5812 Cobban, 1967. Ojito spring, in the NW1/4, NW1/4 sec 29, T16N, R1W. Sandoval County. Oak Canyon Member.

- D5815 Cobban, 1967. About 1-1/2 miles (2.4 km) N30E of Ojito Tank in T16N, R1W, Sandoval County. Oak Canyon Member.
- D5325 Landis and Cobban, 1966. NW1/4 NE1/4 Sec. 33, T14N, R1W, Sandoval County. Paguate Sandstone Tongue, from brown sandstone concretions at top.
- D5321 Cobban, 1966. SE1/4 SE1/4, Sec. 12, T13N, R2W, Sandoval County. Oak Canyon Member, from dark-brown-weathering calcareous sandstone concretion.
- D5324 Landis and Cobban, 1966. NW1/4 NW1/4, Sec. 7, T13N, R1W, Sandoval County. Paguate Sandstone Tongue.
- D5383 Dane and Landis, 1966. About 1/4 mile (0.4 km) south and 1-1/2 miles (2.4 km) east of the northwest corner of Puerco Dam quadrangle, Sandoval County. Paguate Sandstone Tongue.
- D5366 Dane and Landis, 1966. NE1/4, Sec. 29, T12N, R3W, Sandoval County. Oak Canyon Member, from brown-weathering sandy limestone concretions 66 ft (20 m) above base.
- D4018 Dane, 1963. Center of Sec. 29, T12N, R3W, Sandoval County. Paguate Sandstone Tongue.

COCKERELL, T. D. A., 1915.

Tertiary mollusca from New Mexico and Wyoming.
Amer. Mus. Nat. Hist. Bull., 33:101-107.

Viriparus trochiformis and Campeloma calamodontis (n. sp.) are two gastropods reported from the San Jose Formation near Ojo San Jose.

COLBERT, E. H., 1950.

Mesozoic vertebrate faunas and formations of northern New Mexico.
Soc. Vert. Paleont. Guidebook, 4th Field Conf., 57-73.

There are two general areas in northern New Mexico where Mesozoic vertebrates can be found. One is the drainage of the Chama River where the Triassic, Jurassic and Cretaceous are exposed and the other are exposures of Cretaceous sediments in the San Juan Basin. He discussed the Chinle fauna, mentioned fishes from the Todilto Formation, and stated that up to 1950 no vertebrate fossils had been found in the Morrison, although bones may be eventually recovered after a diligent search. Colbert touched upon the fossil content of the Cretaceous formations in a general manner. He listed the faunas from the Fruitland, Kirtland and Ojo Alamo formations.

COLBERT, E. H., 1960.

Triassic rocks and fossils.

New Mexico Geol. Soc. Guidebook, 11th Field Conf., 55-62.

The Triassic sediments of northern New Mexico form a sequence of sandstones, siltstones, and clays of a highly variegated nature which are included in the Chinle Formation. Among the fossil vertebrates mentioned in this article are Coelophysis, a primitive theropod dinosaur, Phytosaurus (Machaeropsopus) a phytosaur, Typothorax an armored thecodont reptile and Eupelor (Buettneria) a metoposaur.

COLBERT, E. H., 1972.

Vertebrates from the Chinle Formation.

Mus. Northern Ariz. Bull., 47:1-12.

In this paper, Colbert reviews very briefly the vertebrates which occur in the Chinle Formation and illustrates several of the forms. None have been reported occurring within the boundaries of the study areas but they could occur there.

COLBERT, E. H., 1974.

The Triassic paleontology of Ghost Ranch.

New Mexico Geol. Soc. Guidebook, 25th Field Conf., 175-178.

Although fossils are known from the Aqua Zarca, Poleo and Petrified Forest members of the Chinle Formation, it is only in the latter member that there is comprehensive paleontological evidence bearing upon the Late Triassic life of

New Mexico. Fossil leaves and wood are locally common in the Aqua Zarca, Poleo and Petrified Forest beds with the ancient conifer Araucarioxylon being the most characteristic. The Poleo has yielded cycadeoids such as Zamites, and Yuccites. Besides plants there are fossil unionids (fresh water clams), fishes (Ceratodus - a lungfish), amphibians (Metoposaurus - a large labyrinthodont) and reptiles (Typothorax, Rutiodon, Coelophysis).

COPE, E. D., 1874.

Notes on the Eocene and Pliocene lacustrine formations of New Mexico, including descriptions of certain new species of vertebrates.
Annual report . . . Surveys west of the 100th meridian (Wheeler Survey):115-130.

This is the original description of Cope's fieldwork in New Mexico. Twenty five new species of fossil vertebrates, mostly mammals, from the San Jose Formation were described.

COPE, E. D., 1875a.

The Vertebrata of the Cretaceous formations of the West.
U.S. Geol. Survey Terr. (Hayden) Rept., 2:1-303.

A summary, listing the taxa described in Cope (1874) and their descriptions, with some emendation and elaboration is given in this article.

COPE, E. D., 1875b.

Systematic catalogue of Vertebrata of the Eocene of New Mexico
collected in 1874.

U.S. Geol. Surveys west of the 100th meridian (Wheeler Survey):1-37.

With some minor revisions, this paper is essentially a reprint of
Cope (1874) and (1875a).

COPE, E. D., 1875c.

Reports on the geology of that part of northwestern New Mexico examined
during the field season of 1874.

Annual report . . . Surveys west of the 100th meridian (Wheeler Survey):61-97.

This article is a synopsis of the itinerary of the Wheeler Survey with some
observations on San Juan Basin geology.

COPE, E. D., 1876a.

On the supposed carnivora of the Eocene of the Rocky Mountains.
Acad. Nat. Sci. Phila. Proc., 1875:444-448.

The Creodonta, primitive early Tertiary carnivores whose fossils come from
the Rocky Mountain region, were discussed. Their distribution which includes the
San Juan Basin was summarized.

COPE, E. D., 1876b.

On a gigantic bird from the Eocene of New Mexico.
Acad. Nat. Sci. Phila. Proc., 1876:10-11.

Diatryma gigantea, a giant flightless bird, is described from a partial tarsometatarsus found in the San Jose Formation in the San Juan Basin, New Mexico.

COPE, E. D., 1876c.

On the Taeniodonta, a new group of Eocene Mammalia.
Acad. Nat. Sci. Phila. Proc., 1876:39.

The order Taeniodonta was first proposed in this publication. Its diagnostic characters were discussed.

COPE, E. D., 1876d.

On the geologic age of the vertebrate fauna of the Eocene of New Mexico.
Acad. Nat. Sci. Phila. Proc., 1876:63-66.

Comparison and correlation of Eocene fauna of New Mexico was made with others of the Rocky Mountain region and of Europe.

COPE, E. D., 1876e.

On some supposed lemurine forms of the Eocene Period.
Acad. Nat. Sci. Phila. Proc., 1876:88-89.

This paper consists of a discussion of the affinities of Cope's genus Tomotherium (type from the San Juan Basin) and the proposal of the new order "Bunotheria."

COPE, E. D., 1877.

Report upon the extinct vertebrates obtained in New Mexico by parties of the expedition of 1874.

U.S. Geographical Surveys West of the 100th Meridian (Wheeler), 4:1-370.

An extensive report dealing with the geology and vertebrate paleontology of the early Eocene [San Jose Formation] of northwestern New Mexico. This represents a comprehensive summary of the earliest work on the fossil vertebrates of the San Juan Basin. From these findings came the basic geological and paleontological foundation upon which many later articles are based. Many new taxa were named from fossils found on this expedition.

COPE, E. D., 1881a.

Mammalia of the lower Eocene beds.

Amer. Nat., 15:337-338.

This is apparently the first report of fossil vertebrates from the "Puerco" [Nacimiento Formation]. Both turtles and mammals have been cited, with only the latter being named. Two new genera and species (Periptychus carinidens and Deltatherium fundaminis) were named and briefly described.

No localities were mentioned.

COPE, E. D., 1881b.

On some Mammalia of the lowest Eocene beds in New Mexico.

Amer. Philos. Soc. Proc., 19:484-495.

This paper contains the description of several new genera and species of mammals from the San Juan Basin in New Mexico. Included new taxa are Mesonyx navajovius, n. sp. (type - ? lower jaw with dentition), Periptychus carinidens, n. gen. et sp. (type - ? lower jaw with incomplete dentition), Triisodon quiverensis, n. gen. et sp. (type - lower jaw with

incomplete dentition), Deltatherium fundaminis, n. gen. et sp. (type - two maxilla with nearly complete dentition), Conoryctes comma, n. gen. et sp. (type - lower jaw with incomplete dentition), Catathlaeus rhabdodon, n. gen. et sp. (type - ? cranial material including dentition), Anisonchus sectorius, n. gen. et sp. (type - upper and lower dental material), Mioclaenus turgidus, n. gen. et sp. (type - ? lower jaw with dentition), M. subtrigonus, n. sp. (type - incomplete skull with dentition), Phenacodus puercensis, n. sp. (type - upper and lower dentition), P. zuniensis, n. sp. (type - lower jaws of two individuals), Protogonia subquadrata, n. gen. et sp. (type - upper cheek teeth) and Meniscotherium terraerubrae, n. sp. (type - dentition of several individuals). No locality data was given.

COPE, E. D., 1882a.

Contributions to the history of the Vertebrata of the lower Eocene of Wyoming and New Mexico made during 1881. Amer. Philos. Soc. Proc., 20:139-197.

Most of the vertebrate fossils discussed in this article are from Wyoming. This fauna was compared to that from the San Juan Basin in New Mexico. Several new taxa from the latter area were described. These include Psittacotherium aspasiae, n. sp. (type - lower jaw of a subadult with partial dentition), Sarcothraustes antiquus, n. gen. et. sp. (type - M² and M³ incomplete lower jaws with partial dentition of one individual), Champsosaurus puercensis, n. sp. (type - three dorsal and four caudal vertebrae of one individual) and C. sapoensis, n. sp. (type - vertebrae). No specific locality data was given.

COPE, E. D., 1882b.

Synopsis of the Vertebrata of the Puerco Eocene epoch.
Amer. Philos. Soc. Proc., 20:461-471.

This paper contains a listing of all vertebrate fossils discovered to date in the Puerco Formation of the San Juan Basin. The aggregate of specimens was considered sufficient to characterize the Puerco fauna.

Four new species were added to the fauna in this paper:

Hyopsodus acolytus (type - upper and lower molars of two individuals), Didymictis haydenianus (type - left maxillary and dentary with incomplete dentition), Haploconus xiphodon (type - dentary with partial dentition and Meniscotherium tapiacitis (type - lower jaw with partial dentition).

COPE, E. D., 1882c.

A new genus of Tillodonta.
Amer. Nat., 16:156-157.

This short report contains the description of a new genus and species of tillodont from the Puerco (Nacimiento) Formation, San Juan Basin, New Mexico (Psittacotherium multifragum). The type is apparently a lower jaw with dentition. No locality data was given.

COPE, E. D., 1882d.

Two new genera of the Puerco Eocene.
Amer. Nat., 16:417-418.

The two new genera and species described in this report, Haploconus lineatus and Pantolambda bathmodon, evidently come from the Puerco (Nacimiento) Formation in northwestern New Mexico. H. lineatus is based on several specimens, including upper and lower dentitions. Although unclear, it appears that the second species H. angustus, previously assigned to Mioclaenus, was placed in this genus. The type of Pantolambda bathmodon is a lower jaw with partial dentition.

COPE, E. D., 1882e.

A new genus of Taeniodonta.
Amer. Nat., 16:604-605.

The new genus and species assigned to the order Taeniodonta actually represents a new multituberculate, Taeniolabis sulcatus (type - a single tooth). Evidently the type specimen comes from the Puerco (Nacimiento) Formation of New Mexico.

COPE, E. D., 1882f.

New marsupials from the Puerco Eocene.
Amer. Nat., 16:684-686.

Three new species and one new genus, considered marsupials, were reported from the Puerco (Nacimiento) Formation of New Mexico. The new taxa include Polymastodon taoensis, n. gen. et sp. (type - lower dentition), Ptilodus trovessartianus, n. sp. (type - three P_4 s) and Haploconus entoconus, n. sp. (type - lower jaw with partial dentition). No locality data was given.

COPE, E.D., 1882g.

A new form of Taeniodonta.
Amer. Nat., 16:831-832.

This report is another of a series of short articles in which new taxa was described from the Puerco (Nacimiento) Formation of the San Juan Basin, New Mexico. The new genus and species Hemiganus vultuosus was only tentatively assigned to the order Taeniodonta. It is not possible to determine exactly what constitutes the type specimen but upper and lower teeth were described and measured. No localities were given.

COPE, E. D., 1882h.

Some new forms from the Puerco Eocene.
Amer. Nat., 16:833-834.

Five new species of mammals were named in this article (Mioclaenus protogonoides, type - upper molars; M. opisthacus, type - lower dentition, three individuals listed; M. baldwini, type - lower jaw with dentition; Protogonia plicifera, type - lower jaw with dentition; Dissacus carnifex, type-lower jaw with dentition). Presumably all the above taxa were based on specimens from the Puerco (Nacimiento) Formation of the San Juan Basin. No locality data.

COPE, E. D., 1883a.

New mammalia from the Puerco Eocene.
Amer. Nat., 17:191.

This article is a summary of a talk given by Cope before the American Philosophical Society in which nine new vertebrate taxa from northwestern New Mexico were described. Except for Helagras prisciformis, a snake, all are mammals. The new taxa are: Mixodectes pungens, n. gen. et sp.,

M. crassiusculus n. sp., Triisodon levisianus, n. sp., Phenacodus calceolatus n. sp., Mioclaenus meniscus, n. sp., M. bucculentus, n. sp., and M. ferox n. sp. No type specimens were mentioned in connection with these new species. No specific localities were given.

COPE, E. D., 1883b.

Some new Mammalia of the Puerco Formation.
Amer. Nat., 17:968.

This article is the summary of a talk given before the Philadelphia Academy. The new taxa named were from northwestern New Mexico. Included forms are Zetodon gracilis, n. gen. et sp., Periptychus coarctatus, and Pantolambda cavirictus. No localities were mentioned.

COPE, E. D., 1883c.

First addition to the fauna of the Puerco Eocene.
Amer. Philos. Soc. Proc., 20:545-563.

Fifty-five species are included in this synopsis of the Vertebrata of the Puerco "epoch." Ten are Reptilia, the remainder Mammalia. In this paper a number of interesting additions were made. The typical specimens were figured in the fourth volume of the U.S. Geological [Geographical] Survey of the Territories.

New Vertebrata included in this paper are Helagras prisciformis, n. gen. et sp. (type - vertebrae), Triisodon levisianus, n. sp. (type - incomplete dentary with dentition), Mioclaenus ferox, n. sp. (type - incomplete skeleton including partial dentition), M. bucculentus, n. sp. (type - incomplete maxillary with dentition), M. corrugatus, n. sp. (type - maxillary with P^4-M^3 and several postcranial bones), Mixodectes pungens, n. sp. (type - lower jaws with dentition), M. crassiusculus, n. sp. (type - fragments

of two lower jaws from different individuals) and Phenacodus calceolatus, n. sp. (type - skull fragments with dentition and limb bones of one individual. No locality data was given.

COPE, E. D., 1884a.

On new lemuroids from the Puerco Formation.
Amer. Nat., 18:59-62.

It appears that only one new species was named in this article, Indrodon malaris (type specimen - incomplete skull with dentition). Its characters were given and its relationship with other early forms, some of which are not positively lemuroids, discussed. No locality was mentioned.

COPE, E. D., 1884d.

Second addition to the knowledge of the Puerco epoch.
Amer. Philos. Soc. Proc., 21:309-324.

This article represents a paper read before the American Philosophical Society. Several new mammalian taxa from the San Juan Basin in New Mexico were named and described. Included new forms are Didymictis primus, n. sp. (type - two maxillaries with dentition and an incomplete dentary with M_{2-3} , all from different individuals), Triisodon assurgens, n. sp. (type - lower jaw with P_4-M_3), Mioclaenus cuspidatus, n. sp. (type - ? upper dentition), Chriacus truncatus, n. sp. (type - ? maxilla with dentition), C. simplex, n. sp. (type - maxilla and incomplete dentary with partial dentition), Tricentes crassicolldens, n. gen. et sp. (type - ? partial skull with dentition), I. inaequidens, n. sp. (type - incomplete skull with partial dentition), Indrodon malaris, n. gen. et sp. (type - partial skull with dentition), Anisonchus agapetillus, n. sp. (type - six incomplete dentaries with partial dentition), A.

cophater, n. sp. (type - lower jaw with three cheek teeth), Chirox
plicatus, n. gen. et sp. (type -P³, M²⁻³) and Catopsalis fissidens, n.
sp. (type - incomplete lower jaw with dentition).

COPE, E. D., 1885a.
The oldest Tertiary Mammalia.
Amer. Nat., 19:385-386.

Four new mammalian taxa were briefly described in this paper from the Early Tertiary Puerco Formation in the San Juan Basin of New Mexico. These included Loxolophus adapinus, n. gen. et sp. (type specimen - lower molars), Polymastodon latimolis, n. sp. (type specimen - lower jaw with dentition), Chriacus hyattianus, n. sp. (type specimen - two maxillae and an incomplete lower jaw with partial dentitions) and Sarcothraustes coryphaeus, n. sp. (type specimen - incomplete skull with partial dentition). No specific locality data was included.

COPE, E. D., 1885b.
Marsupials from the lower Eocene of New Mexico.
Amer. Nat., 19:493-494.

Several species of presumed marsupials (actually multituberculates) from the Puerco beds in the San Juan Basin are briefly discussed in this paper. One of these is new, Polymastodon attenuatus (type specimen - dentary with complete dentition). No locality data was included.

COPE, E. D., 1885c.

The relations of the Puerco and Laramie deposits.
Amer. Nat., 19:985-986.

Cope demonstrated that the Puerco and Laramie deposits are not correlative, but that the former is of later age. The Laramie deposits, as he pointed out, contain abundant dinosaurian material, whereas the Puerco deposits contain none. Cope predicted that when the Cretaceous mammalian fauna is better known, it will agree with the Puerco in its leading features.

COPE, E. D., 1886

The Plagiaulacidae of the Puerco Epoch.
Amer. Nat., 20:451.

Three species representing this family of marsupials were recovered from the Puerco deposits in New Mexico: Ptilodus mediavus, P. trovessartianus and Neoplagiaulax americanus. A fourth species, N. molestus, was added to the family (type specimen - P_4) which is the largest so far known. No specific localities were mentioned.

COPE, E. D., 1887.

Some new Taeniodonta of the Puerco.
Amer. Nat., 21:469.

A right mandibular ramus from the upper beds of the Puerco Formation is a new species of Psittacotherium. This new species is P. megalodus and exceeds the size of the other two known species of the genus. No specific localities were mentioned.

COPE, E. D., 1888a.

Synopsis of the vertebrate fauna of the Puerco series.
Amer. Philos. Soc. Trans., 16:298-361.

This paper is one of the earliest published accounts of the fossil vertebrates from the San Juan Basin of New Mexico. The fossils come from the Puerco Formation as recognized by Cope. The taxa presented some of which were new, received discussion at moderate length. New taxa included a turtle, Chelydra crassa (type specimen - no number given, an incomplete caropace and plastron) and Onychodectes tisonensis. No specific localities were mentioned.

COPE, E. D., 1888b.

Vertebrate fauna of the Puerco series.
Science, 11:198.

This article evidently is the summary of a verbal report. It was stated that the Puerco series of New Mexico represented a time between the Cretaceous and Eocene, and therefore, is not referable to either one or the other. At the time of this report, 106 vertebrate species had been described from these beds: 12 reptiles, 1 bird and 93 mammals.

COPE, E. D., 1888c

The vertebrate fauna of the Puerco epoch.
Amer. Nat., 22:161-163.

This paper reviewed, to that time, the Puerco fauna in very general terms and included some findings which necessitated some revision. Also included were concepts of ancestral mammals [therians], their observed and supposed characters. The vertebrates included 106 species and the invertebrates include 4. Fossil wood is also known in the unit. No localities were given.

DANE, C. H., W. A. COBBAN, AND E. G. KAUFFMAN, 1966.
Stratigraphy and regional relationships for the Juana Lopez Member,
Mancos Shale, in the San Juan Basin, New Mexico.
U.S. Geol. Surv. Bull., 1224H:1-15.

A well exposed stratigraphic section near La Ventana, New Mexico was presented as the reference section for the Juana Lopez Member. Ribbed oysters, Inoceramus and the ammonite Prionocyclus, Baculites, Coilopoceras and Scaphites dominate the faunas in the 9 beds of this member. Fossils in the Juana Lopez Member on the east side of the San Juan Basin are distributed in distinct laterally persistent faunal zones.

DANE, C. H., E. G. KAUFFMAN AND W. A. COBBAN, 1968.
Semilla Sandstone, a new member of the Mancos Shale in the
southeastern part of San Juan Basin, New Mexico.
U.S. Geol. Surv. Bull., 1254-F:1-21.

The Semilla Sandstone is a sandstone member in the lower part of the Mancos Shale in northwestern Sandoval County, New Mexico. It crops out along the west side of the valley of Arroyo Semilla in the northern part of San Ysidro 15 minute quadrangle. This member has a north-south extension of about 35 miles and east-west extent of 7 to 8 miles. The type section of this member lies within the ammonite zone of Prionocyclus hyatti (Stanton) as defined by Cobban and Reeside. Mollusks and arthropods are abundant. Among the fauna are plicate oysters, Pinna, Cymbophora, Turritella, Trigonarca, Tellina, Cardium, and others. The beds are riddled to within 15 feet of the top of the member at several levels by the burrowing of marine worms and callianassid crabs. A crab carapace was collected.

The type locality for the Semilla Sandstone is 2000-3000 feet north of Ojo del Espiritu Santo (Holy Ghost Spring) and about 1 mile east of New Mexico State Highway 44 on Ojo del Espiritu Santo Grant, San Ysidro quadrangle, Sandoval County, New Mexico.

DELEVORYAS, T., 1959.

Investigations of North American cycadeoids:

Monanthesia.

Amer. Jour. Bot., 46:657-666.

This article discusses the history, anatomy and relationships of Monanthesia with special emphasis on the specimens collected from the Upper Cretaceous of the San Juan Basin of New Mexico. He assigned all of these specimens to the species M. magnifica. No specific localities were mentioned.

EVERNDEN, J. F., D. E. SAVAGE, G. H. CURTIS AND G. T. JAMES, 1964.

Potassium-argon dates and the Cenozoic mammalian chronology of North America.

Amer. Jour. Sci., 262:145-198.

This important paper provides radiometric dates for the established North American mammal ages. They leave little doubt that the defined Land Mammal Ages are time sequential and that the potassium-argon method of dating is sufficiently accurate to distinguish events separated by 0.2×10^6 years at 1.5×10^6 years, and 1×10^6 years at 50×10^6 years. The Puercan and Torrejon Ages, based on Paleocene mammals from the San Juan Basin of New Mexico, were listed in this paper and a number of taxa given which characterizes them.

FASSETT, J. E., 1973.

The saga of the Ojo Alamo Sandstone; or the rock-stratigrapher and the paleontologist should be friends.
Cretaceous and Tertiary Rocks of the southern Colorado Plateau, Four Corners Geol. Soc. Mem., 123-130.

The author gives his version of the history of the Ojo Alamo Sandstone nomenclature and the problems associated with it and its age. The vertebrates have been the basis for the age determinations. Dinosaurs (Cretaceous) are present in the lower portion and Paleocene mammals are present in the top.

FASSETT, J. E. AND J. S. HINDS, 1971.

Geology and fuel resources of the Fruitland Formation and Kirtland Shale of the San Juan Basin, New Mexico and Colorado.
U.S. Geol. Surv. Prof. Paper, 676:1-76.

The article gives the depositional history of the Upper Cretaceous and Paleocene formations in the San Juan Basin. The fuel resources, such as uranium, oil, gas and coal, of the Fruitland Formation and Kirtland Shale, as well as their occurrences, were also discussed. Fasset and Hinds included preliminary analysis of mammalian fossils from the Fruitland Formation by Clemens. They listed the following:

Multituberculata

Mesodma

Cimolodon

Marsupialia

Alphadon marshi

Pedimys sp.

Eutheria

Gypsonictops sp.

Cimolestes sp.

A therian mammal which cannot be referred with any certainty to the Marsupialia or Eutheria. Ostrea is mentioned as the most abundant fossil in the Fruitland Formation. Locally it forms coquina beds. Fossil wood, some 4-5 ft in diameter, is abundant throughout this formation.

FLESCH, G. A., 1974.

Stratigraphy and sedimentology of the Morrison Formation (Jurassic), Ojito Spring Quadrangle, Sandoval County, New Mexico: a preliminary discussion.
New Mexico Geol. Soc. Guidebook, 25th Field Conf., 185-195.

This article is concerned with the surface distribution and stratigraphic sections of the members of the Morrison Formation. Fossils mentioned were: trace fossils (burrows) locally in the Recapture Shale Member, "Skolithus" type burrows in the Westwater Canyon Sandstone, sparse petrified wood and dinosaur bone in the channel sandstone units of the Brushy Basin, and humate, lignitic wood and trace fossils (burrows) in the Jackpile Member.

FUCHS-PARKER, J. W., 1977.

Alibi for a Mesa Verde misfit--the La Ventana Formation Cretaceous Delta, New Mexico.
New Mexico Geol. Soc. Guidebook, 29th Field Conf., 199-206.

Based upon trough cross-stratification of sandstones in the La Ventana area, he postulates a delta with a general southeast source. Leaf fossils were found as impressions in sandstones just north of the town of La Ventana and in ironstone concretionary beds among shales and coaly shales in several localities, but are best in Sec. 9, T19N, R1W. Large, tubular, brown pipe-and gourd-shaped cavities occur in Sec. 20, T19N, R1W in the main sandstone members. These appear to have entry passages and living chambers. These may represent lungfish burrows. On the Shelby ranch

at San Pablo, T20N, R1W, sharks teeth and pelecypod shells are abundant. Clam shell impressions occur in the lower portion of the Hosta Sandstone Member in Sec. 2, T18N, R1W. Elongated Ostrea are present in the upper part of the Hosta Sandstone Member in Sec. 5, T18N, R1W.

GAZIN, C. L., 1937.

Hunting for fossils in the Navajo country.
Explor. Fldwk. Smith Inst., 1936:19-22.

This article contains a general discussion of field work done in the San Juan Basin in 1936. Several sites, some discovered by Cope were collected in Paleocene and Eocene deposits but no specific locality data was given.

GAZIN, C. L., 1968

A new primate from the Torrejon middle Paleocene of the San Juan Basin, New Mexico.
Biol. Soc. Wash. Proc., 81:629-634.

Primates had not been known from the Torrejon beds of the Nacimiento Formation in New Mexico until reported from the Angel Peak basin by Wilson (1951, 1956). A new genus and species was described and discussed (Torrejonina wilsoni, type specimen - USNM No. 25255, lower jaw including P_3-M_2).

GILMORE, C. W., 1916.

Contributions to the geology and paleontology of San Juan County, New Mexico: part 2, vertebrate faunas of the Ojo Alamo Kirtland and Fruitland formations.
U.S. Geol. Surv. Prof. Paper, 98-Q:297-308.

This paper attempts to bring together all the information up to 1916 relative to the fossil vertebrate fauna of the Ojo Alamo

beds and the immediately underlying deposits. Prior to this paper, considerable numbers of genera and species were described in widely scattered publications. Two new chelonian species were described (Neurankylus baueri, type specimen - USNM No. 8344, carapace and plastron; Baena nodosa, type specimen - USNM No. 8345, nearly complete carapace and plastron).

GILMORE, C. W., 1919.

Reptilian faunas of the Torrejon, Puerco, and underlying Upper Cretaceous formations of San Juan County, New Mexico.
U.S. Geol. Surv. Prof. Paper, 119:1-68.

Specimens described in this article were collected in several zones of the Puerco, Torrejon, Ojo Alamo, Kirtland and Fruitland formations at many localities in the San Juan Basin, New Mexico. These collections were especially rich in turtle remains, and represent one of the best single collections of fossil turtles from the southwestern United States. Sixteen new species were described. The recovery of additional, though incomplete dinosaur specimens, reveals forms not previously reported. Presence of fish and crocodile was recorded on the basis of incomplete materials.

GILMORE, C.W., 1921.

Discovery of sauropod dinosaur remains in the Upper Cretaceous of New Mexico.
Science, 54:274.

The discovery of the scapula of a sauropod dinosaur in the Ojo Alamo Formation of the San Juan Basin was announced in this short article. Its significance is that it represents the first reported Late Cretaceous sauropod in North America. The size and configuration of this specimen precludes its belonging to another dinosaurian group. No specific locality data was given.

GILMORE, C. W., 1922.

A new sauropod dinosaur from the Ojo Alamo Formation of
New Mexico.
Smithsonian Misc. Coll., 72:1-9.

In this article the first sauropod dinosaur from Late Cretaceous deposits in North America was named and described. It was recovered from Barrel Spring Arroyo, one mile south of Ojo Alamo, San Juan County, New Mexico. This new taxon was named Alamosaurus sanjuanensis, n. gen. et sp. (type specimen - USNM No. 10486, a nearly complete scapula). In addition to the type, a nearly complete ischium found about 200 feet distant from the scapula at the same stratigraphic level was also referred to this species.

GILMORE, C. W., 1928.

Fossil lizards of North America.
Mem. Nat. Acad. Sci., 22(3):1-201.

Gilmore described Machaerosaurus torrejonensis, a new genus and species, from the east fork of Torrejon Arroyo, San Juan County, New Mexico. The remains are of an unusually perfect skull.

GILMORE, C. W., 1935.

On the Reptilia of the Kirtland Formation of New Mexico, with descriptions of new species of fossil turtles.
U.S. Nat. Mus. Proc., 83:159-188.

The reptilian fossils described in this paper include several genera of dinosaurs and turtles collected from the San Juan Basin. Fairly definite locations are given for most of the specimens although some were collected by amateurs. One fish tooth, family Squatinidae,

was also recorded. Four new chelonian species were reported and described (Baena ornata, type specimen - USNM No. 13229, carapace and plastron; Boremys grandis, type specimen - USNM No. 12979, carapace and plastron; Thescelus hemispherica, type specimen - USNM No. 12818, incomplete carapace and plastron; Asperidites ovatus, type specimen - USNM No. 12986, incomplete carapace and plastron fragments).

GRANGER, W., 1914.

On the names of lower Eocene faunal horizons of Wyoming and New Mexico.
Amer. Mus. Nat. Hist. Bull., 33:201-207.

This article names the Almagre and Largo "beds" of the Wasatch [San Jose Formation] of northwestern New Mexico. The absence of Eohippus was considered noteworthy. The genus Meniscotherium is restricted to the Largo.

GRANGER, W., 1915.

A revision of the lower Eocene Wasatch and Wind River faunas. Part III-- Order condylarthra. Families Phenacodontidae and Meniscotheriidae.
Amer. Mus. Nat. Hist. Bull., 34:329-361.

Systematic revision of the phenacodontid and meniscotheriid condylarths, including many specimens from the San Jose Formation. It is well illustrated.

GRANGER, W., 1917.

Notes on Paleocene and lower Eocene mammal horizons of northern New Mexico and southern Colorado.
Amer. Mus. Nat. Hist. Bull., 37:821-830.

This paper gives brief results of field work in the San Juan Basin. Two of the three areas collected are in New Mexico;

one in the Angel Peak area, the other between Aztec and Cedar Hill along the Animas River. A number of mammalian taxa, mostly at the generic level, are listed but not discussed. However, approximate stratigraphic levels have been recorded for them.

HAY, O. P., 1911.

Descriptions of eight new species of fossil turtles from west of the one-hundredth meridian.
Proc. U.S. Nat. Mus., 38(1747):307-326.

He described the new species Compsemys parva, C. vafer, Basilemys nobilis, Adocus vigoratus and Hoplochelys bicarinata from near Ojo Alamo, San Juan County, New Mexico.

HOOK, S. C. AND W. A. COBBAN, 1977.

Pycnodonte newberryi (Stanton); common guide fossil in Upper Cretaceous New Mexico.
New Mexico State Bur. Mines Miner. Resour., Ann. Rept., 1976-77: 48-54.

The Late Cretaceous oyster Pycnodonte newberryi (referred to in the older literature as Gryphaea newberryi) fits the criteria as a guide or index fossil for the Late Cenomanian and early Turonian in New Mexico and adjacent Four Corners States. A large scale map shows localities where this fossil occurs in the San Juan Basin and elsewhere in the region.

KAY, R. F., AND M. CARTMILL, 1974.

Skull of Palaechthon nacimienti.
Nature, 252:37-38.

The specimen upon which this article is based comes from Kutz Canyon in the San Juan Basin of New Mexico. It was previously described by Wilson and Szalay (1972). This article briefly discusses the affinities of Palaechthon nacimienti and then more fully treats its morphology.

KAY, R. F., AND M. CARTMILL, 1977.

Cranial morphology and adaptations of Palaechthon nacimienti and other Paromyidae (Plesiadapoidea (?) Primates), with a description of a new genus and species.

Jour. Human Evol., 6:19-53.

This article is an expanded version of Kay and Cartmill (1974) with a detailed functional analysis of the skull of Palaechthon nacimienti.

KNOWLTON, F. H., 1916.

Contributions to the geology and paleontology of San Juan County, New Mexico, part 4, flora of the Fruitland and Kirtland Formations. U.S. Geol. Surv. Prof. Paper, 98:327-344.

The fossil plant materials upon which Knowlton's report was based came from 20 different localities. Fifteen were from the Fruitland Formation, three from the Kirtland Shale and two from the Ojo Alamo Sandstone. The majority of his materials were collected from lower or the coal-bearing portion of the section. Most of the fossil plants were preserved on a red baked shale, indicating proximity to coal.

Some of Knowlton's localities are: 1) Fruitland Formation, just across San Juan River from Fruitland, about 1/2 mile above the bridge, San Juan County, New Mexico; 2) Fruitland Formation, 30 miles south of Farmington and one mile east of reservation line, San Juan County, New Mexico.

KNOWLTON, F. H. 1924.

Flora of the Animas Formation.

U.S. Geol. Surv. Prof. Paper, 134:71-117.

This report is based upon fossil plant remains collected in the northeast portion of the San Juan Basin in Colorado. Knowlton described 59 species of fossil plants from this formation. Three of these are ferns. One is a palm and the remainder are assigned to dicots.

Some localities close to the study area are: 1) Ignacio quadrangle, Colo. 5 miles south of Durango, in SE 1/4 NW 1/4 sec 13, T34N, R10W 400 to 500 feet above the base of upper Animas beds. 2) Ignacio Quadrangle, Colorado east side of sec. 21, T35N, R6W, 1650 feet above the base of McDermott Formation.

KUES, B. S., J. W. FROELICH, J. A. SCHIEBOUT AND S. G. LUCAS, 1977. Paleontological survey, resource assessment, and mitigation plan for the Bisti-Star Lake Area, northwestern New Mexico. U.S. Bur. Land Manage., Albuquerque Office, Oct. 31, 1977:1-399.

A comprehensive paleontological survey of the San Juan Basin was made from March to October, 1977. It provides data relevant to fossil sites and known occurrences of recoverable coal. Most of the area contains exposures of Cretaceous and Early Tertiary rocks representing a spectrum from fully marine to fully terrestrial environmental conditions. Included formations yield an almost unparalleled record of one of the most important episodes in the history of life - the abrupt change from terrestrial communities dominated by dinosaurs to those dominated by mammals.

Over 1100 fossil-bearing sites were discovered in this survey, most of them in areas likely to be disturbed by coal recovery. Many of the fossils from these sites have been identified and appear in the report on faunal lists.

Recommendations were made to establish six areas in the study area as paleontological reserves. These preserved areas should be completely protected for future paleontological research.

LAMB, G. M., 1964.

Microfaunal changes within lower Mancos Shale, San Juan Basin,
New Mexico and Colorado (abstract).
Geol. Soc. Amer. Special Papers, 82:117.

The occurrence of forams belonging to six distinct zones in the lower Mancos Shale were related to calcium carbonate content of the shales. Greatest concentrations of calcium carbonate and planktonic foraminifera are found in the transgressive phases, low calcium carbonate content, and a marked decrease in foram abundance, mainly arenaceous, is typical of regressive phases. No specific locality data was given.

LAMB, G. M., 1968.

Stratigraphy of the lower Mancos Shale in the San Juan Basin.
Geol. Soc. Amer. Bull., 79:827-854.

The stratigraphy of the lower Mancos Shale in the San Juan Basin was discussed and correlated. Foraminifera within the lower Mancos were identified, and the paleogeography and paleoecology of the sediment interpreted. The identification and occurrence of the foraminifera at two sections was presented in some detail.

In the area of his Section 7 at La Ventana, N. Mex. about 205 feet above the Greenhorn Formation is a sandy interval with numerous concretions which contains various species of Inoceramus, Coilopoceras colleti, Prionocyclus hyatti, Spathites sp., Romaniceras sp., Pinna cf. P. petrina and Pachychiloides cf. P. chrysalloides.

SE 1/4 Sec. 15, T25N, R1E. The Juana Lopez interval makes a low cuesta. Near the top of the cuesta, the fossiliferous concretion beds occur which contains Coilopoceras and Prionocyclus.

LAMB, G. M., 1969.

Two new species of foraminifera from the Lower Mancos Shale (Upper Cretaceous) of the San Juan Basin, New Mexico. Cushman Found. for Foraminiferal Res., 20:143-144.

Two new species of foraminifera (Ammomarginulina carlilensis and Haplophragmium arenafum) were described from the lower Mancos Shale in Red Wash, approximately 1/4 mile north of Highway 504 in Sections 11 and 12, T30N, R20W, San Juan Co., New Mexico.

LANDIS, E. R., C. H. DANE AND W. A. COBBAN, 1973.

The Dakota Sandstone and Mancos Shale in the Laguna-Acoma-Grants area, New Mexico.
Four Corners Geol. Soc. Mem., 28-36.

The intertongued Dakota Sandstone and Mancos Shale formations were divided into formal and informal rock units in this report. In their measured sections at NE1/4, SE1/4, Sec. 20, and SW1/4, NW1/4, Sec. 21, T10N, R5W, Laguna 7-1/2 minute quadrangle, Valencia County, New Mexico, Gryphea newberryi and Sciponoceras gracile occur in the Twowells Sandstone Tongue and Ophiomorpha sp., Exogyra sp. and Acanthoceras amphibolum are found in the Paguate Sandstone Tongue. Exogyra sp. and Plicatula arenaria are present in the Cubero Sandstone Tongue and Oak Canyon Member of the Dakota Sandstone.

LEE, W. T., 1917.

Geology of the Raton Mesa and other regions in Colorado and New Mexico. U.S. Geol. Surv. Prof. Paper, 101:9-221.

A comprehensive discussion of the stratigraphy of the Raton Basin and adjacent areas, including the San Juan Basin is given. Faunal and floral lists as well as correlations of some units were included.

LINDSAY, E. H., L. L. JACOBS, AND R. F. BUTLER, 1978.
Biostratigraphy and magnetostratigraphy of Paleocene terrestrial
deposits, San Juan Basin, New Mexico.
Geology, 6:425-429.

Biostratigraphy in combination with magnetostratigraphy yields a stratigraphic-chronologic foundation in which biological and environmental changes can be correlated with an independent time frame. This combination promises greater resolution of chronostratigraphic units than those based on faunal change and superposition. The occurrences of early and middle Paleocene land mammals in the San Juan Basin are bracketed relative to the magnetic polarity time scale: mammals of Puercan (early Paleocene) age occur in rocks deposited during magnetic anomaly 28, and mammals of Torrejonian (middle Paleocene) age occur in rocks deposited during magnetic anomaly 26 and during the reversed polarity interval preceding anomaly 26.

LUCAS, S. G., 1977.
Vertebrate paleontology of the San Jose Formation, east-central San Juan Basin, New Mexico.
New Mexico Geol. Soc. Guidebook, 28th Field Conf., 221-224.

This paper has outlined and, in some cases, offered tentative solutions for several of the problems facing vertebrate paleontologists in the San Jose Formation. Many of these problems would not have arisen if previous collectors had carefully recorded stratigraphic and geographic provenance and also thoroughly studied and reported their collections. Unfortunately such ideals are almost never met in the study of paleontology.

The road is now open for thorough restudy and revision of former collections. In addition, further collecting, using new methods and a rigorous stratigraphic framework, is necessary. The method of screenwashing for microvertebrate fossils (McKenna, 1965) should be especially productive of new information. With the solution of the problems outlined here and the influx of new information, paleontologists will finally gain a relatively clear and unbiased picture of the vertebrates existing during Wasatchian time in the San Juan Basin of New Mexico.

MANNHARD, G. W., 1976.

Stratigraphy, sedimentology and paleoenvironments of the La Ventana Tongue of the Mesa Verde group (Upper Cretaceous), southeastern San Juan Basin, New Mexico.

Unpubl. Ph.D. dissertation, Univ. New Mexico, 182 p.

Paleoecological study of the La Ventana Tongue of the Cliff House Sandstone and adjacent units (Menefee Formation and Lewis Shale) in the southeastern San Juan Basin.

MARSH, O. C., 1894.

Description of Tertiary artiodactyls.

Amer. Jour. Sci., 48:259-274.

This article consists of descriptions of Eohyus distans (= Phenaceda primaevus) and Eohyus robustus (= Periptychu carinidens) from the San Juan Basin.

MATEER, N. J., 1976.

New topotypes of Alamosaurus sanjuanensis Gilmore (Reptilia: Sauropoda).

Geol. Inst. Univ. Uppsala N.S., 6:93-95.

The material reported, an ilium, sacrum and two caudal vertebrae, was collected by Charles Sternberg in 1922 from Barrel Spring near Ojo

Alamo, San Juan County, New Mexico. These bones belong to a large sauropod of rather late geological occurrence. Because these specimens are fragmentary and not particularly well preserved, a detailed comparative study was not practical. However, the morphology of these specimens and the fact that they came from the same locality as Gilmore's type specimen, suggests that they belong to the species Alamosaurus sanjuanensis, thus making them topotypes.

MATTHEW, W. D., 1897.

A revision of the Puerco fauna.
Amer. Mus. Nat. Hist. Bull., 9-259-323.

An attempt to analyze the Paleocene mammalian fauna, from the previously recognized Puerco and Torrejon formations, was made in this fairly substantial paper. It serves to review the work done in the San Juan Basin of New Mexico by Cope earlier in the 19th Century. The known taxa were listed, papers containing their descriptions cited and brief discussions presented.

MATTHEW, W. D., 1913.

A zalambdodont insectivore from the basal Eocene.
Amer. Mus. Nat. Hist. Bull., 32:307-314.

This paper named and described a new genus and species of zalambdodont insectivore from the Paleocene Nacimiento Formation of the San Juan Basin, New Mexico. The new taxon is Palaeoryctes puercensis (type specimen - AMNH No. 15923, skull and jaw with partial dentition). It was compared with several related forms, both extinct and living.

MATTHEW, W. D., 1914.

Evidence of the Paleocene vertebrate fauna on the
Cretaceous-Tertiary problem.
Geol. Soc. Amer. Bull., 25:381-402.

Paleocene vertebrates from various localities in North America were listed, generally discussed and compared, both with each other and with the known European fauna. The most typical and best known fauna reportedly comes from the Puerco and Torrejon Formations of the San Juan Basin, New Mexico. No specific localities were mentioned.

MATTHEW, W. D., 1915a.

A revision of the lower Eocene Wasatch and Wind River faunas. Part I--
Order Ferae (Carnivora). Suborder Creodonta.
Amer. Mus. Nat. Hist. Bull., 34:4-103.

This is a systematic revision of early Eocene creodonts of North America, including many specimens from the San Jose Formation.

MATTHEW, W. D., 1915b.

A revision of the lower Eocene Wasatch and Wind River faunas. Part II--
order Condylarthra. Family Hyopsodontidae.
Amer. Mus. Nat. Hist. Bull., 34:311-328.

This paper is a systematic revision of the hyopsodontid condylarths of the North American early Eocene, including many specimens from the San Jose Formation.

MATTHEW, W. D., 1918.

A revision of the lower Eocene Wasatch and Wind River faunas. Part V--
Insectivora (continued).
Amer. Mus. Nat. Hist. Bull., 38:565-657.

This article is a systematic revision of selected insectivores (sensu lato), rodents and palaeonodons from the North American early Eocene, including some specimens from the San Jose Formation.

MATTHEW, W. D., 1937.

Paleocene faunas of the San Juan Basin, New Mexico.
Amer. Phil. Soc. Trans., 30:1-374. 85 Figs.

This monograph is a classic paper on Paleocene vertebrates, mostly mammals, from the San Juan Basin. Known Cretaceous vertebrates were listed and briefly discussed. Relationships of the Paleocene vertebrates were widely discussed and a number of correlations made. Seven new vertebrate species, all mammalian, were described in this paper (Protogonodon kimbetovius, type specimen - AMNH No. 16397, lower jaws with DP_4-M_2 ; Ectoconus majusculus, type specimen - AMNH No. 16500, skull and nearly complete skeleton; Ellipsodon aequidens, type specimen - AMNH No. 823, upper and lower jaw with P_4-M_3 ; Neoclaenodon procyonoides, type specimen - AMNH No. 16554, upper and lower jaws with partial dentition; Ellipsodon priscus, type specimen - AMNH No. 16403, lower jaws with partial dentition; Pentacodon occultus, type specimen - AMNH No. 16592, lower jaw with P_4-M_3).

MATTHEW, W. D. AND W. GRANGER, 1921.

New genera of Paleocene mammals.
Amer. Mus. Novitates, 13:1-7.

Only descriptions and brief discussions were included in this paper on Paleocene mammals from the Mason Pocket in the Tiffany beds of Colorado and the San Juan Basin of New Mexico. Taxa from the latter locality include Eucosmodon americanus, n. gen. (type - Neoplagiaulax americanus Cope); Thylacodon pusillus, n. gen. et sp. (type specimen - AMNH No. 16414, lower jaw fragment with M_{2-3}); Acmeodon secans, n. gen. et sp. (type specimen - AMNH No. 16599, lower jaw fragment with P_2-M_2); Euconodon, n. gen. (type - Sarcothraustes coryphaeus Cope); and Mixoclaenus encinensis, n. gen. et sp. (type specimen - AMNH No. 16601, upper and lower jaws with partial dentition). No locality data was given.

MOOK, C. C., 1930.

A new species of crocodilian from the Torrejon Beds.
Amer. Mus. Novitates, 447:1-11.

In the American Museum collections of fossil reptiles are the remains of a crocodilian from the Torrejon beds at Torrejon Arroyo, New Mexico. This represents a new species. Leidyosuchus multidentatus (type specimen - AMNH No. 5179), which is based on a lower jaw, skull fragments, isolated teeth and several postcranial bones, presumably from one individual. No other crocodilian fossils have previously been recorded from the Torrejon beds. Further study may show that this specimen more properly belongs to a new genus. A description of this new species and comparisons to related taxa were given.

MOOK, C. C., 1942.

A new fossil crocodilian from the Paleocene of New Mexico.
Amer. Mus. Novitates, 1189:1-4.

A new genus and species of crocodilian was described from the head of the west fork of Kimbetoh Wash in the Torrejon Formation of the San Juan Basin. The newly described taxon is Navajosuchus novomexicanus (type specimen - AMNH No. 5186, incomplete skull).

OSBORN, H. F., 1898.

A complete skeleton of Coryphodon radians; notes upon the locomotion of this animal.
Amer. Mus. Nat. Hist. Bull., 10:81-92.

Osborn briefly mentions Wortman's 1896 expedition to the San Juan Basin and some of the results of that work.

OSBORN, H. F., 1923.

A new genus and species of Ceratopsia from New Mexico,
Pentaceratops Sternbergii.
Amer. Mus. Novitates, 93:1-3.

At a locality nine miles northeast of Tsaya, New Mexico in the Fruitland Formation, a fine skull and parts of a skeleton were collected by Charles H. Sternberg. The specimen represents a ceratopsian with one nasal horn in the median line, two horns above the orbits, and two lateral horns projecting downwards and backwards below the orbits. Hence, the generic name Pentaceratops.

OSTROM, J. H., 1961.

A new species of hadrosaurian dinosaur from the Cretaceous
of New Mexico.
Jour. Paleont., 35:575-577.

The new hadrosaurian species reported in this article is Parasaurolophus cyrtocristatus (type specimen - CNHM No. P27393, partial skeleton with cranial material including a complete cranial crest) from the Fruitland Formation, McKinley County, New Mexico. It is the first known crested hadrosaur from the formation. The locality was given as near Coal Creek, eight miles southeast of Tsaya, McKinley County.

OSTROM, J. H., 1963.

Parasaurolophus cyrtocristatus, a crested hadrosaurian dinosaur
from New Mexico.
Fieldiana, 14:143-168.

This article was an elaboration of the author's 1961 report in which this species was originally named and described. No specific locality data was given.

OWEN, D. E., 1973.

Depositional history of the Dakota Sandstone, San Juan Basin area,
New Mexico.
Four Corners Geol. Soc. Mem., 37-51.

The Dakota Sandstone in the San Juan Basin area includes strata which were deposited under diverse marine and non-marine conditions. The paper shows the primary structures, bioturbation, fossils and lithologies of this formation. From this data, he formulated a model to explain changes in environments in time and space. The author stated that fossils in the Dakota are not really as rare as usually assumed. Many beds, especially in the upper part of the Dakota and in the southeastern portion of the San Juan Basin, contain oysters in great numbers, other bivalves, gastropods, a few ammonites and plants. In addition, several types of trace fossils are common in many beds of the formation.

POWELL, J. S., 1973.

Paleontology and sedimentation of the Kimbeto Member of the Ojo Alamo Sandstone.
Cretaceous and Tertiary Rocks of the southern Colorado Plateau.
Four Corners Geol. Soc. Mem., 111-122.

A brief history of the stratigraphy of the Ojo Alamo Sandstone was given, and the author proposed that the Ojo Alamo Sandstone as defined by Bauer (1916, p. 276) be reinstated and further proposed the name Naashoibito Member be retained for the middle shales and lower conglomerate, and that the upper conglomerate be named the Kimbeto Member of the Ojo Alamo Sandstone.

A history of the paleontology was discussed. The taxa of the Hunter's Wash Local Fauna (near Bisti) and the Alamo Local Fauna (near Ojo Alamo Spring) were included. However, these faunas are partly from the Kirtland Shale and the Fruitland Formation, as well as, from the Ojo Alamo Sandstone.

The most productive fossil locality in the Kimbeto Member is in NW 1/4 sec. 32, T25N, R12W, off a small tributary of Hunter's Wash. This fauna was named the Montsco Local Fauna and included mammal and dinosaur remains.

The Puerco fauna is known only from the lower 100 feet of the Nacimiento Formation in a belt from Chico Springs to Tsosie Arroyo (Bettonie Tsosie Arroyo). The Kimbeto Member may span the Cretaceous-Tertiary boundary.

RATKEVICH, R. P., 1976.

Dinosaurs of the Southwest.

Univ. New Mexico Press, Albuquerque, N.M. 1-115.

This is a generalized book on dinosaurs. It covers the earliest dinosaurs to those that became extinct in the Cretaceous. He mentioned several famous localities for dinosaurs in New Mexico, but nothing specific.

REESIDE, J. B., JR., 1924.

Upper Cretaceous and Tertiary formations of the western part of the San Juan Basin Colorado and New Mexico.

U.S. Geol. Surv. Prof. Paper 134:1-70.

This paper presents a more or less detailed description of the formations, geologic map and columnar sections of the Upper Cretaceous and Tertiary formations of the San Juan Basin of Colorado and New Mexico. Reeside mentioned the flora and fauna of these formations.

REYNOLDS, T. E., 1936.

Two new insectivores from the Lower Paleocene of New Mexico.

Jour. Paleont., 10:202-209.

One of the new forms described (Puercolestes simpsoni, n. gen. et sp., type specimen - St. Louis Univ. No. 101, palate with incomplete dentition) was classified as an insectivore, but the other was actually listed as a creodont (Escatepos campi, n. gen. et. sp., type specimen - St. Louis Univ. no.

118, palate with incomplete dentition). Both were obtained from the Puerco beds in the Arroyo Eduardo of the san Juan Basin, New Mexico at Granger and Sinclairs locality 7.

RIGBY, J.K., JR., AND S. G. LUCAS, 1977.

Fossil mammals from the Ojo Alamo Sandstone.

New Mexico Geol. Soc. Guidebook Supl., 28th Field Conf., 55-56.

Recently recovered fossil mammal material documents the basal Tertiary age of the upper part of the Kimbeto member of the Ojo Alamo Sandstone along Betonnie Tsosie Wash. If the sandstone body is equivalent to a similar body in the Barrel Springs Arroyo section of Butler, Lindsay and Jacobs (1977) then the Cretaceous/Tertiary contact can be stated with some confidence to be located within the Kimbeto member. This data suggests the placement of the boundary substantially below paleomagnetic anomaly 30 of Butler, Lindsay and Jacobs and serves to reduce the ambiguity of the contact in the San Juan Basin.

ROMER, A. S., 1950.

The Upper Paleozoic Abo Formation and its vertebrate fauna.

Soc. Vert. Paleont. Guidebook, 4th Field Conf., 48-56.

This article states the only noteworthy Paleozoic vertebrate fauna of New Mexico is that of the early Permian redbeds of the Abo formation. In general terms, he mentioned several localities. One was in the Canyon between Jemez Springs and Jemez Pueblo. The fauna of the Abo is similar

to that of the Wichita Group of Texas. Common to both regions are the familiar pelycosaur Edaphosaurus, the more primitive pelycosaur Ophiacodon, the cotylosaurs Diadectes and Captorhinus (rare in New Mexico), the amphibians Eryops, Broiliellus (or Aspidosaurus?), Zatrachys and Pantylus. New Mexico has several genera such as Limnoscelis not found in Texas.

ROMER, A. S., 1960.

The vertebrate fauna of the New Mexico Permian.
New Mexico Geol. Soc. Guidebook, 11th Field Conf., 75-77.

The only Paleozoic vertebrate assemblage of New Mexico of note is that of the early Permian Abo and Cutler formations, mainly known from two areas in the Chama River drainage in Rio Arriba County. The fauna is of interest as one of the first to be noted in the history of New Mexican geology and, incidentally, as one of the factors in initiating the famous feud between Cope and Marsh, famous figures in American vertebrate paleontology in the last century. From near Jemez Springs, remains of Sphenacodon ferocious, diadectids and amphibians were collected.

RUSSELL, L. S., 1930.

Upper Cretaceous dinosaur faunas of North America.
Amer. Philos. Soc. Proc., 69(4):133-159

This is a report on dinosaur-bearing formations of North American Upper Cretaceous which were divided into four stages. Russell placed the faunas of the Fruitland, Kirtland and Ojo Alamo in the third or Fox Hills stage. He listed the dinosaurs described from these formations and considered them to represent one fauna. No specific localities were given.

SIEMERS, C. T. AND N. R. KING, 1974.

Macroinvertebrate paleoecology of a transgressive marine sandstone.
Cliff House Sandstone (Upper Cretaceous) Chaco Canyon, northwestern
New Mexico.
New Mexico Geol. Soc. Guidebook, 25th Field Conf., 267-277.

The authors listed the invertebrates which occur in Cliff House Sandstone in Chaco Canyon and show that they comprise four different assemblages. Although there are certain exceptions, they indicate that their living relatives live mostly in shallow marine environments. The authors concluded that the Cliff House Sandstone represents a near stand still of the strandline.

SIMONS, E. L., 1963.

David Baldwin, O. C. Marsh and the discovery of the first continental
Paleocene faunas of the New World.
Postilla, 75:1-11.

This article discusses the time, place and circumstances of discovery of the first known land mammals of the New World Paleocene. Although the listed localities are inexact, any such data was unusual for the 19th century. The first locality is between La Plata and Aztec, New Mexico. The second is six or seven miles north of Angel Peak on the south side of the San Juan River.

SIMPSON, G. G., 1936a.

Additions to the Puerco fauna, lower Paleocene.
Amer. Mus. Novitates, 849:1-11.

The published descriptions and comments of this article were originally prepared as an appendix to "Paleocene Faunas of the San Juan Basin, New Mexico," by W. D. Matthew (1937). Several new genera and species of mammals from the Puerco Formation in Bitonitsoseh and Barrel Spring Arroyos, were briefly diagnosed and discussed in this article
(Kimbetohia campi, n. gen. et sp., type specimen - UCMF

No. 31305, skull fragment with M_1-M_3 ; Chriacus antiquus, n. sp., type specimen - AMNH No. 27713, right and left lower jaws with partial dentition; Tiznatzinia vanderhoofi, n. sp., type specimen - UCMP No. 31264, partial lower left jaw with P_4-M_2 ; Plagiptychus matthewi, n. gen. et sp., type specimen - AMNH No. 27712, lower right jaw with P_2-M_2). Bitonitsoseh Arroyo is the nameless arroyo of Granger and Sinclair and is sometimes called Eduardo Arroyo.

SIMPSON, G. G., 1936b.
Census of Paleocene mammals.
Amer. Mus. Novitates, 848:1-14.

In the course of a general review of the Paleocene mammalian faunas, Simpson compiled a list of all the definitely identified genera found in the Paleocene formations of the world. The information was widely scattered in over a hundred papers by twenty-five or thirty authors. The publication of this generic list facilitated, not only the task of identifying Paleocene mammals, but efforts to learn something of these important faunas. The San Juan Basin in New Mexico is one of the few North American localities yielding Paleocene mammals. No locality data was given.

SIMPSON, G. G., 1941.
Mounted skeleton and restoration of an early Paleocene mammal.
Amer. Mus. Novitates, 6(1155):1-7.

This is a discussion of a skeleton of Ectoconus majusculus collected from the Puerco (Nacimiento?) Formation of Kimbeto Arroyo, San Juan Basin, New Mexico.

SIMPSON, G. G., 1948.

A fossil collecting campaign in New Mexico.
Science, 107:207-212.

This article is a popular account of vertebrate collecting in the summer of 1947. Simpson described Triassic localities in the Ghost Ranch area. He mentioned a discovery site for the Eocene mammal Meniscotherium at the head of the north branch of Oso Arroyo, northeast of Lindrith, New Mexico.

SIMPSON, G. G., 1948b.

The Eocene of the San Juan Basin, New Mexico.
Amer Jour. Sci., 246:257-292, 363-385.

This is the original proposal of the rock-stratigraphic unit "San Jose Formation" and a complete historical summary of previous research, both geological and paleontological, in the Eocene of the San Juan Basin. A locality map and measured sections were included.

SIMPSON, G. G., 1950a.

Cenozoic formations and vertebrate faunas.
Soc. Vert. Paleont. Guidebook, 4th Field Conf., 74-85.

This article includes a brief overview of the stratigraphy and paleontology of the lower Tertiary rocks of the San Juan Basin.

SIMPSON, G. G., 1950b.

Lower Tertiary formations and vertebrate faunas of the San Juan Basin.
New Mexico Geol. Soc. Guidebook, 1st Field Conf., 85-89.

This article is a reprint of part of Simpson (1950a) with minor changes and a more extensive discussion.

SIMPSON, G. G., 1951.

Hayden, Cope and the Eocene of New Mexico.
Acad. Nat. Sci. Phila. Proc., 103:1-21.

This paper, mostly a narrative, cited the background and some general contributions to geology and paleontology by Hayden and Cope. It presents an historical account of Cope's work in the San Juan Basin of New Mexico and the events leading to it in some detail. One of the purposes of this paper was to locate as accurately as possible the sites that Cope collected, and his journal was frequently quoted in establishing them. A large map on plate 1 shows the general location of several of Cope's localities in the area.

SIMPSON, G. G., 1954.

An apatemyid from the early Eocene of New Mexico.
Amer. Mus. Novitates, 1654:1-4.

The status of the family Apatemyidae was briefly given and a new species from the Almagre facies of the San Jose Formation of the San Juan Basin described. Only the type of this new taxon, Teilhardella whitakeri, has thus far been discovered (type specimen - AMNH No. 48004, partial lower left jaw with P_4-M_1). A brief diagnosis appeared for this type in addition to modest comparisons with related taxa. AMNH locality 59 was given. This is near the headwaters of the Largo.

SIMPSON, G. G., 1955.

The Phenacolemuridae, new family of early primates.
Amer. Mus. Nat. Hist. Bull., 105:411-442.

Phenacolemur jepseni (n. sp.) was named from a skull found in the Regina Member of the San Jose formation in Arroyo Blanco (Simpson's "Quarry 88").

SIMPSON, G. G., 1959.

Fossil mammals from the type area of the Puerco and Nacimiento strata,
Paleocene of New Mexico.
Amer. Mus. Novitates, 1957:1-22.

This paper briefly discussed the significance of Paleocene mammals from
the San Juan Basin of New Mexico and the early paleontological work done there.

Locality 230

North of Cuba: Upper part of Nacimiento, about 50 feet below top of
that formation, locality 219.

West of tip of Cuba Mesa: About 200-225 feet above base of Nacimiento;
localities 222, 226, 229. About 100-125 feet above base of Nacimiento;
locality 230.

Locality 216

Lower part of Nacimiento, level not more exactly determined; mid-
dle of east line of sect. 20, T21N, R1W.

Fossils: Leaves, not identified.

Locality 217

Within bottom 50 feet of Nacimiento exposures in SW 1/4 of SE 1/4,
sect. 16, T21N, R1W.

Fossils: Fragmentary skeletal bones of at least two species of small
mammals; not identifiable, but recorded for possible future collecting
and as the first mammals found in the type region of Puerco and Nacimiento.

Locality 218

A few feet below locality 217 and in the same one-sixteenth section.

Fossils: Crocodilian jaw, not identified.

Localities 219 and 220

Near middle of south half of sect. 10 T21N, R1W.

Localities 221, 222, and 223

About 1/2 to 3/4 mile west of southeastern point of Cuba Mesa, in second spur of Nacimiento beds from that point. Levels traced into section (fig. 1) and there indicated. Localities 221, 222, and 223 are on same slope; locality 223 is about 60 feet below 221; and locality 222 is 2-3 feet below locality 223.

Fossils: Locality 221: Poorly preserved chelonian, not identified. Locality 222: Periptychus carinidens; leaves, not identified. Locality 223: Poorly preserved chelonian, not identified.

Locality 226

All in the same stratum, 10 to 15 feet thick, in a continuous stretch of exposures over an area about 1/4 mile in diameter, northwest to west-northwest of southeastern tip of Cuba Mesa on fourth main spur projecting southward from the mesa, mainly or wholly in sect. 3, T20N, R2W. Level traced into section (fig. 1) and there shown. Its bottom is about 15 feet above a relatively persistent small lignite seam and its top about 5 feet below a thinner, less persistent, carbonaceous band which is the level of locality 222.

Fossils: Psittacotherium multifragum?; Tricentes subtrigonus; Tetraclaenodon puercensis; Haploconus angustus; Periptychus carinidens and cf. carinidens; chelonian, not identified; crocodilian, not identified; and garfish scales.

SINCLAIR, W. J., 1914.

A revision of the bundont Artiodactyla of the middle and lower Eocene of North America.
Amer. Mus. Nat. Hist. Bull., 33:267-295.

This paper is concerned with Marsh's "Eohyus robustus" considered to be a synonym of Periptychus. Several other primitive artiodactyls, some of which are known from specimens from the San Jose Formation in the RPRA, were discussed.

SINCLAIR, W. J. AND W. GRANGER, 1914.

Paleocene deposits of the San Juan Basin, New Mexico.
Amer. Mus. Nat. Hist. Bull., 33:297-316.

This is a landmark paper on the stratigraphy of the rocks adjoining the Cretaceous-Tertiary boundary in the western San Juan Basin. It includes a locality map (generalized), photographs and measured sections.

STANTON, T. W., 1916.

Contributions to the geology and paleontology of San Juan County, part 3, Nonmarine Cretaceous invertebrates of the San Juan Basin.
U.S. Geol. Surv. Prof. Paper, 98:309-326.

This paper includes a description of 25 species of bivalves and gastropods collected mostly from the Fruitland Formation, and two species of bivalves from the Kirtland Shale. The fossils were collected within the San Juan Basin in New Mexico and Colorado, mostly near Fruitland and Jewett, New Mexico. Several sites south of the San Juan River and east of the Chaco River in New Mexico have yielded similar fossils.

SULLIVAN, R. M., 1979.

Revision of the Paleocene genus (Glyptosaurus) (Reptilia, Anquidae).
Amer. Mus. Nat. Hist. Bull., 163:1-72.

Revision of Glyptosaurus and allied genera, including description of Paraglyptosaurus yatkolai (new genus and species), based on a nearly complete frontal (AMNH 5181) found in the Regina Member of the San Jose Formation in Arroyo Blanco. More specific locality data was not available as this specimen (5181) was collected by the American Museum Expedition of 1912.

SZALAY, F. S., 1969.

Mixodectidae, Microsyopidae, and the insectivore-primate transition.
Amer. Mus. Nat. Hist. Bull., 140:193-330.

This paper is a comprehensive review of two families whose relationships with the Primates were always a problem. Microsyopids were included in the primates whereas mixodectids were excluded. Navajovius? mckennai was described from a left maxilla (AMNH 48612) collected in the Regina Member of the San Jose Formation at American Museum Quarry 58. Numerous specimens from the Nacimiento and San Jose Formations in the study area were considered in the taxonomic discussions about several genera, especially Microsyops and Mixodectes.

TSCHUDY, R. H., 1973.

The Gasbuggy Core--a palynological appraisal.
Four Corners Geol. Soc. Mem., 131-143.

The bore hole GB-1 in Sec. 36, T29N, R4W, Rio Arriba County was cored to obtain samples for laboratory analysis of rocks to be affected by the nuclear blast.

The pollen assemblages present in samples above 3714 feet are indicative of an early Tertiary Age. Below this, specimens of the genus Protoeacidites, a late Cretaceous index fossil in the Rocky Mountain region, were present. Comparisons were made between the Judith River Formation of Montana, the Teapot Sandstone Member of the Mesaverde Formation of Wyoming, and the Raton and Vermejo formations of New Mexico.

Conspicuous pollen changes observed in the Crevasse Canyon and basal Menefee permit tentative subdivision of this interval into four pollen zones, in ascending order:

Zone 1. That confined to the lower part of the Dilco Coal Member in which triporate pollen is virtually absent; the practical entrance level of triporate pollen in the upper part of the Dilco Coal Member separates this lower unit from all younger samples.

Zone 2. That confined to the lower part of the Gibson Coal Member in which Trudopollis is abundant.

Zone 3. That confined to the upper part of the Gibson Coal Member characterized by high percentages of triporate pollen species, as well as presence of specimens of Pseudoplicapollis in significant percentages.

Zone 4. That confined to the basal Menefee Formation and younger rocks characterized by Proteacidites pollen in significant numbers.

The above pollen zones occur in the stratigraphic interval between the Western Interior invertebrate fossil zones of Scaphites corvensis (upper Turonian) and probably that of Clioscapites choteauensis. Consequently, the interval studied occurs entirely within the Coniacian and Santonian--a time interval of no more than 5 m.y.

THORPE, M. R., 1934.

Meniscotherium robustum sp. nov. and a discussion of Hyracops socialis Marsh.

Amer. Jour. Sci., 5th Ser., 27:401-409.

Meniscotherium robustum (n. sp.) was named for a skull collected by David Baldwin in the San Jose Formation.

VAN HOUTEN, F. B., 1945.

Review of Latest Paleocene and Early Eocene mammalian faunas.

Jour. Paleont., 19(5):421-461.

A review of all of the latest Paleocene (Clark Forkian) and Early Eocene (Wasatchian) mammalian faunas from the Rocky Mountain intermontane basins was given. Comparison of the faunas was made, with a section discussing parts of the San Juan Basin.

The Largo fauna was secured from the upper 350 feet of the Canyon Largo formation at the head of Largo Arroyo and in the area west and southwest of Ojo San Jose drained by the Puerco River tributaries. Meniscotherium is especially common in these beds. Meniscotherium tapiacitis and M. chamense terraerubrae, as well as Ambloctonus sinosus and A. hyaenoides, are diagnostic.

VAN VALEN, L., 1966.

Deltatheridia, a new order of mammals.

Amer. Mus. Nat. Hist. Bull., 132:1-123.

This article is a major reconsideration of the "creodont problem" of eutherian systematics. Oxyaena simpsoni (new species) was named from a maxillary fragment (AMNH 48538) found in the Tapicitos Member of the San Jose formation at American Museum Quarry 150 near Lindrith. Several

specimens from the Nacimiento and San Jose Formations in the study area were considered in discussion of various genera, especially Didelphadus, Oxyaena and Prototomus.

WIELAND, G. R., 1930

Researches in paleobotany: the Mesa Verde cycadeoids.
Carnegie Inst. Washington Yearbook, 29:243-247.

The second season of field exploration in the San Juan Basin of New Mexico was discussed. It resulted in a doubling of the petrified cycad collection from the Mesa Verde. As the trunks had eroded out, many were crushed and flattened. He postulated on the concept of the evolution of Cycadeoidea and early angiosperms. He mentioned the locality for the cycadeoids and petrified woods as in the Chuska Mountains about 25 miles north of Gallup, New Mexico.

WIELAND, G.R., 1934.

Fossil cycads, with special reference to Raumeria reichenbachiana
Geopport sp. of the Zwinger of Dresden.
Palaeontographica, 79B:85-130.

This report is a general discussion of cycadeoids and their anatomy. In discussing their distribution, Wieland reported Monanthesia blanca and M. magnifica from the Mesa Verde Formation of the San Juan Basin, New Mexico. He mentioned the small "flowered" types of the closing Cretaceous as so well exemplified by collections from the San Juan country. He stated that the actual "stamens" are not seen, but the bundles indicate a disk of ten small and "reduced stamens". Monanthesia blanca was considered a new species with "flower" stalks in all leaf base axils. A tangential section of Monanthesia magnifica was illustrated.

WIELAND, G. R., 1936.

Cycadeoid investigations and field work.
Carnegie Inst. Washington Yearbook, 35:333-340.

Wieland discussed the evolution of cycadeoids and their possible ancestry. He reported M. blanca and a new species called M. aequalis from the Mesa Verde Formation. He further reported a specimen of Tempskya, a palm frond and a palm axis from the vicinity of the old "Mexican Springs" trading station, New Mexico. He stated that the Mesa Verde includes the most remarkable series of petrified types of any single western horizon. These include five groups of plants, the conifers, dicots, cycadeoids, palms and true ferns, which are silicified.

WILSON, R. W., 1949.

Preliminary report on a Torrejonian faunule from near Angels Peak,
San Juan Basin, New Mexico (abstract).
Geol. Soc. Amer. Bull., 60(4):1930-1931.

In 1916, Walter Granger obtained a fragmentary mammalian fauna of Torrejonian age from the Nacimiento Formation as exposed near Angels Peak in the San Juan Basin of New Mexico. Only a few genera were identified, and the fossils were found scattered through several hundred feet of the section. Later, the University of Kansas recovered about 145 determinable specimens from a locality in the same area. Considerable importance is attached to this collection because it is not only more diverse than that obtained previously, but also because it was obtained from a single stratigraphic level in a geographic area so small as to approach

quarry conditions. This collection was made approximately at the upper limit stratigraphically of the fossiliferous beds searched by Granger.

The faunule demonstrates clearly the Torrejonian age of the level concerned, but its exact position in time has not been determined. Certain characteristics suggest a slightly different age or, less likely, a slightly different facies, than the collections made farther south and southeast in the better-known sections of the Nacimiento. For example, in respect to size, many of minimum recorded for those of comparable species obtained elsewhere in the basin.

The faunule consists of approximately: Arctocyonidae, 33 per cent; Hyopsodontidae, 21 per cent; Phenacodontidae, 18 per cent; Periptychidae, 15 per cent; Miacidae, 4 per cent; and others 9 per cent. A generic list of mammals follows:

<u>Ptilodontid</u>	<u>Claenodon?</u>	<u>Mioclaenus</u>
<u>Palaeoryctes</u>	<u>Tricentes?</u>	<u>Ellipsodon</u>
<u>Pentacodon</u>	<u>Chriacus</u>	<u>Protoselene</u>
<u>Indrodon</u>	<u>Deltatherium</u>	<u>Tetraclaenodon</u>
<u>Primates?</u>	<u>Triisodon?</u>	<u>Coriphagus</u>
<u>Conoryctine?</u>	<u>Goniacodon</u>	<u>Anisonchus</u>
<u>Psittacotherium?</u>	<u>Didymictis</u>	<u>Periptychus</u>

WILSON, R. W., 1950.

Supposed primates from the Torrejon fauna of the Nacimiento Formation.
Geol. Soc. Amer. Bull., 61:1515-1516.

Specimens with primate-like aspects were obtained from the Nacimiento Formation as exposed in Kutz Canyon drainage a few miles west of Angels Peak. They were tentatively regarded as anaptomorphids, close to members of the Paromomyinae.

WILSON, R. W., 1951.

Preliminary Survey of a Paleocene faunule from the Angel's Peak area, New Mexico.
Kansas Univ. Mus. Nat. Hist. Publ., 5:1-11.

A brief history was given of the discovery of about 150 specimens of mammals from a "pocket" in the Angel's Peak area of the San Juan Basin. The fossils were collected from a three to four foot bed of reddish silt in the NW 1/4 of sec. 14, T27N, R11W, San Juan County, New Mexico. 25 species were identified.

WILSON, R. W., 1956a.

A new multituberculate from the Paleocene Torrejon fauna of New Mexico.
Kans. Acad. Sci. Trans., 59:76-84.

The new multituberculate described in this paper is a species questionably assigned to the genus Ectypodus, E. macrotomus (type specimen - KU No. 7908, right lower jaw with P_3-M_2). It was collected at the head of Kimbetoh Arroyo, San Juan County, New Mexico (NW 1/4 sec. 2, T23N, R9W). This new species was figured, described and compared with related forms at modest length. Also included in this paper are faunal lists for three New Mexico faunules of Torrejonian localities of the University of Kansas (NW 1/4 sec. 14, T27N, R11W, San Juan Co., NW 1/4 sec. 2, T23N, R9W, San Juan Co., and SW 1/4 sec. 20, T22N, R6W, Sandoval Co.).

WILSON, R. W., 1956b.

The condylarth genus Ellipsodon
Kan. Univ. Mus. Nat. Hist. Publ., 9(5):105-116.

The author described the known species of Ellipsodon, explaining the problems associated with various species. The type species of Ellipsodon, E. inaequidens, was collected by D. Baldwin (for E. D. Cope) at Gallegos Canyon (northern San Juan Basin). E.? inaequidens was also collected from Bohannon Canyon. A new species, E. grangeri was described from Kutz Canyon and from Kimbetoh Arroyo. All of these specimens are from the Nacimiento Formation.

Some species of Ellipsodon are referred to Promioclaenus.

WILSON, R. W., 1956c.

Additional remains of the multituberculate genus Eucosmodon.
Kans. Univ. Mus. Nat. Hist. Publ., 9(6):117-123.

Eucosmodon americanus is the type of the multituberculate genus Eucosmodon Matthew and Granger. This species was recorded only from the Puercan (early Paleocene) of the San Juan Basin. Specimens were collected from the Taeniolabis zone of Ojo Alamo and Barrel Springs Arroyos (W1/2, Sec. 11, T24N, R11W) and in the Ectoconus zone 3 miles southeast of Kimbetoh. In addition, a single tooth was collected from Torrejonian strata at the head of Kimbetoh Arroyo (NW1/4, Sec. 2, T23N, R9W).

WILSON, R. W., AND F. S. SZALAY, 1972.

New paromyid primate from middle Paleocene beds, Kutz Canyon area, San Juan Basin, New Mexico.
Amer. Mus. Novitates, 2499:1-18.

A new species of paromyid primate was described from the middle Paleocene (Torrejonian) beds, of Kutz Canyon area, San Juan Basin Palaeochthon nacimienti. This new species is similar to P. alticuspis, the genotype in size and molar morphology, but shows more primitive proportions between the canine and antemolar teeth. A crushed skull of the species shows the primitively dominant facial cranium of early primates. The locality is: NW 1/4, sec. 14, T27N, R11W.

WOOD, A. E., 1962.

The early Tertiary rodents of the family Paramyidae.
Trans. Amer. Phil. Soc., 52:1-261.

This paper represents a long and thorough revision of the most primitive family of rodents. Thisbemys nini was described from a partial skull (YPM 14410) from the ?Tapicitos Member of the San Jose Formation from somewhere in the San Juan Basin, probably near Lindrith. This specimen was collected by David Baldwin in the 1870's so no more precise locality data are available. A number of other specimens from the San Jose Formation within the study area were discussed in connection with the taxonomy of several genera, especially Paramys, Franimys and Thisbemys.

WOODWARD, L. A., W. H. KAUFMAN AND O. L. SCHUMACHER, 1974.

Sandstone copper deposits of the Nacimiento region, New Mexico.
New Mexico Geol. Soc. Guidebook, 25th Field Conf., 295-303.

Copper sulfides and copper-iron sulfides have partly replaced or are closely associated with carbonaceous fossil plant material in sandstones

and arkoses ranging in age from Pennsylvanian to Triassic in the Naciminto region. Fossil plant material occurs as branches and trunks of trees, rounded nodules of fossil wood up to 5 cm in diameter and as thin films along bedding surfaces.

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